Heat Island Mitigation Plan Update

Identifying Strategies for a Cooler Scottsdale

Scottsdale Environmental Advisory Commission

Regular Meeting August 18, 2021

Tonight:

Presentation of ASU's Work to Date

Discussion / Questions and Answers

Next Steps

Possible Direction to Staff & ASU

Possible Recommendations to City Council

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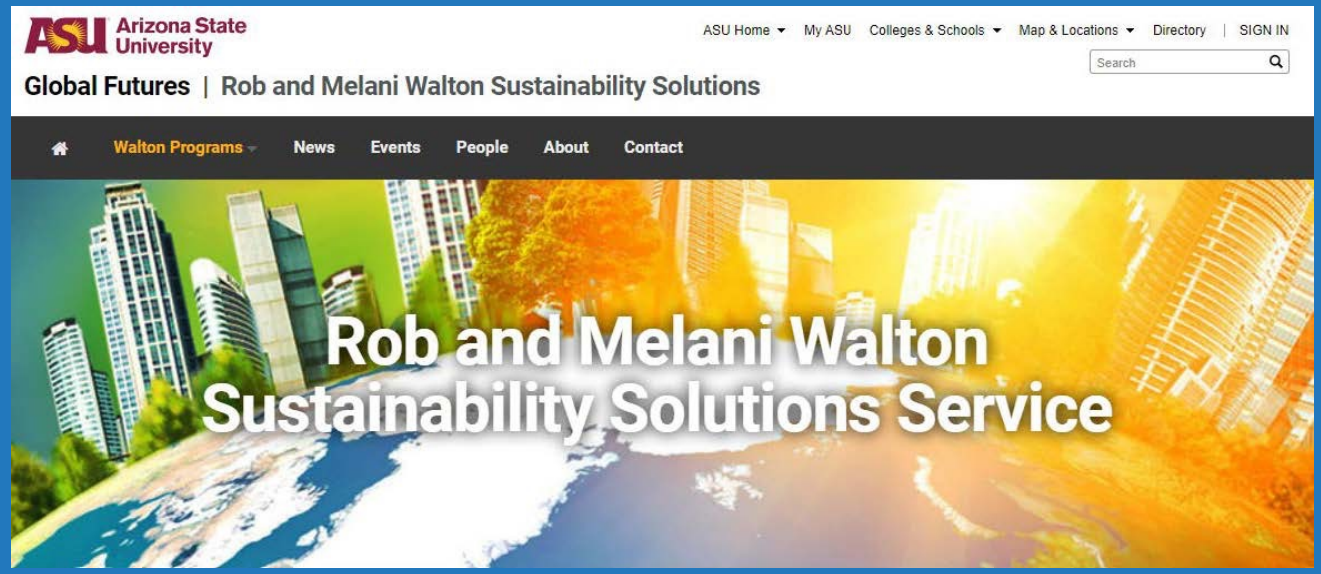
Intergovernmental Agreement Signed July 2020



3-Year Agreement with (3) 1-Year Scopes of Work

Up to $100,000 / Year

Why Start with Urban Heat Island Study?

Input Provided from
Scottsdale Environmental Advisory Commission

Record Elevated Temperatures in Summers

Growth and Density Anticipated in Scottsdale Growth Areas

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Identifying Strategies for a Cooler Scottsdale

First Year Scope of Work FY 2020 – 2021

Urban Climate Research Center
Arizona State University

Rob and Melani Walton Sustainability Solutions Service
Arizona State University

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Project Overview

Bill Campbell

Jenni Vanos

David Hondula

Mary Wright

David Sailor

ASU Urban Climate Research Center
Arizona State University

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Project Overview

- Conduct a series of assessments to…
  - Aid the city in prioritizing programs and policies
  - Provide staff and residents with a better understanding of current risks, and possible heat mitigation and adaptation options

- September 2020–June 2021

Project Overview

- Microclimate Assessment
- Microclimate Modeling
- Mitigation and Adaptation Strategies
- Education and Policy Development
- Reports and Presentations

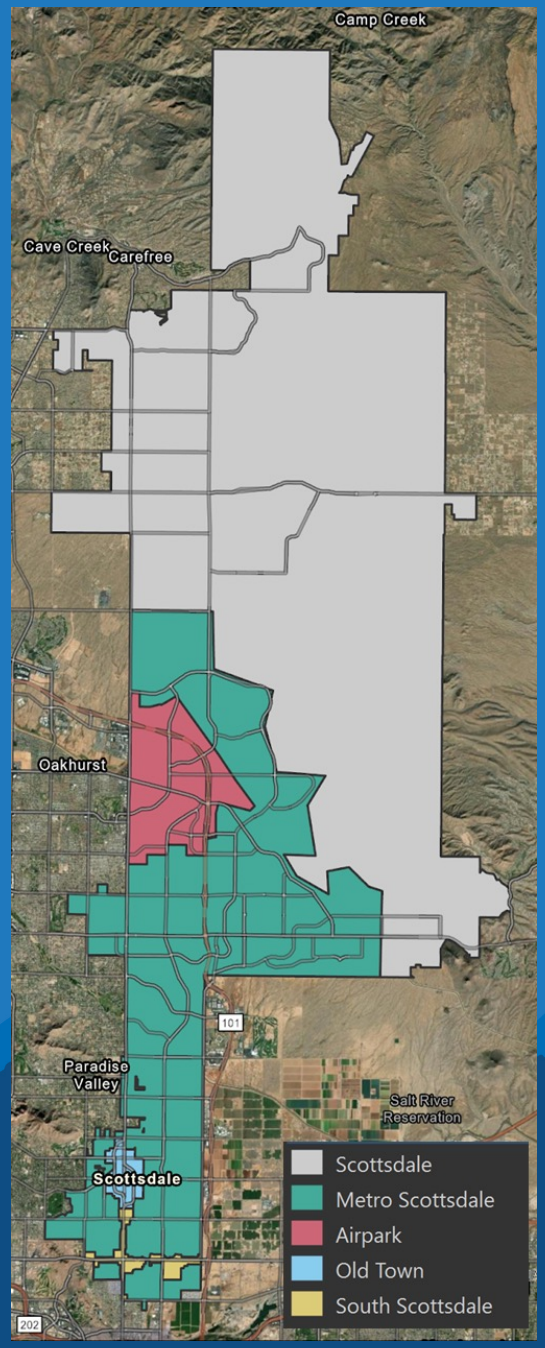
Project Overview

- Deliverables
  - Technical report (two volumes)
  - Data package
  - StoryMap
  - Presentations to staff, SEAC, City Council

Project geography & key terms

- Growth areas
- “Metro Scottsdale”
- Scottsdale
- Census block groups
- Parcels

- Air temperature
- Surface temperature
- Mean radiant temperature



Today's presentation

- Interruptions welcome!

- Overview of recommendations
- Land cover analysis
- Land surface temperature analysis & modeling
- Tree analysis
- Mean radiant temperature analysis & thermal photography
- Possible actions to support recommendations

HeatReady Cities Framework

Mitigation Actions
(make the city cooler and more comfortable)

- Green infrastructure
- Materials and coatings
- Waste heat
- Shade structures
- Water features
- Building geometry
- Air movement

Adaptation Actions
(help people cope with heat)

- Messaging and education
- Cool public places
- Cool homes
- Cool workplaces+
- Reliable infrastructure
- Schedules and routes
- Social cohesion and support

Internal Actions
(support decision-making by city staff)

- Roles and responsibilities
- Visions and goals
- City plans
- External coordination
- Community input
- Data resources
- Capacity building

Equity, Sustainability, and Institutionalization

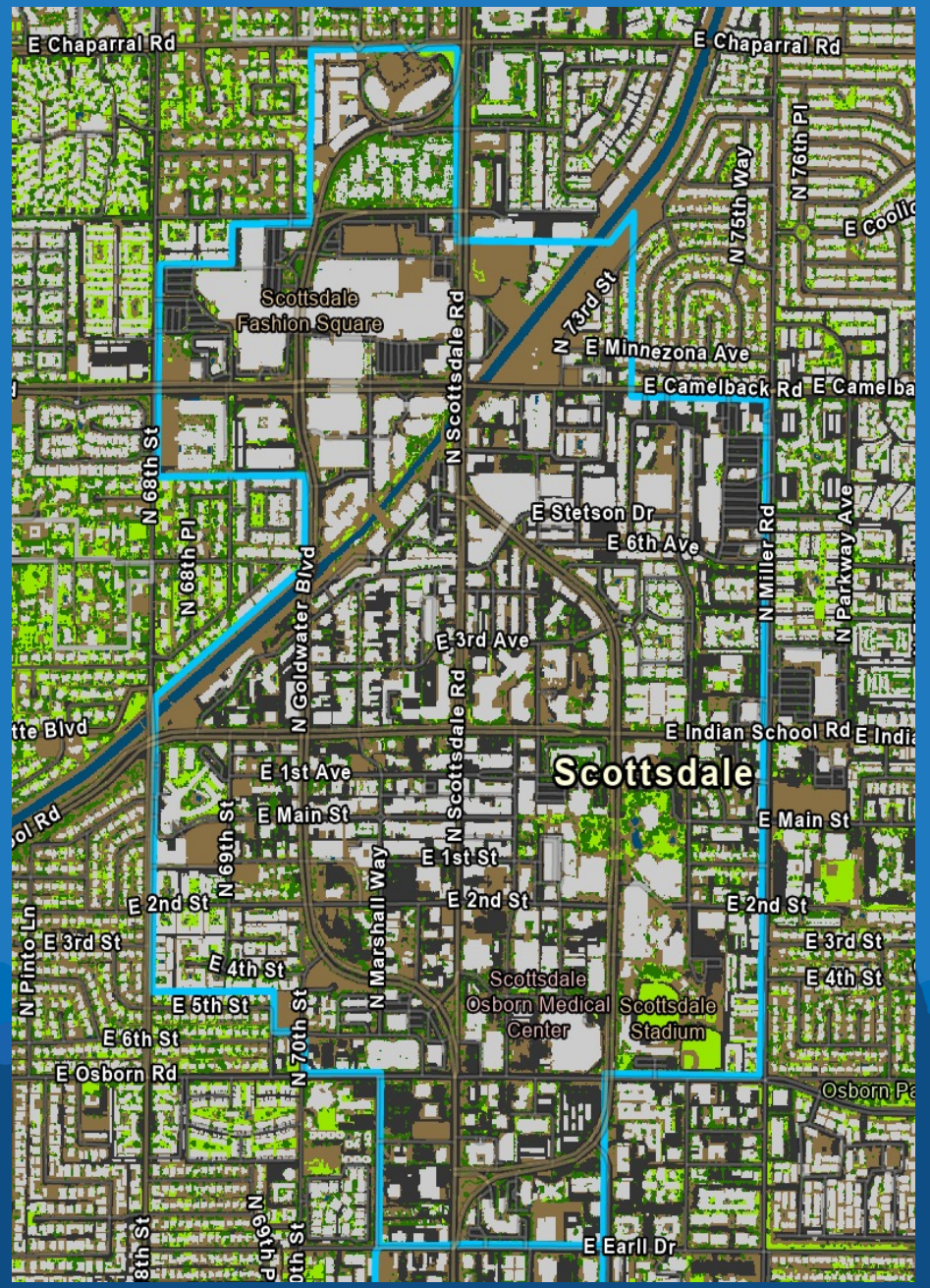
Recommendations

1. Increase tree canopy in the city, particularly along frequently traveled pedestrian walkways and along the south and west facades of buildings
2. Reduce the land area of exposed dark asphalt, dark roofs, and other hot surfaces
3. Provide pedestrian shade amenities through building-integrated and free-standing shade structures, particularly along frequently traveled walkways and in locations that support public transportation

(4. & 5. to be detailed in volume 2)

Land cover analysis

- Aerial imagery from 2015
- Classification from CAP LTER
- 1 meter scale
- 94% accuracy



Water
Tree & Shrub
Grass
Bare Soil & Concrete
Building
Asphalt

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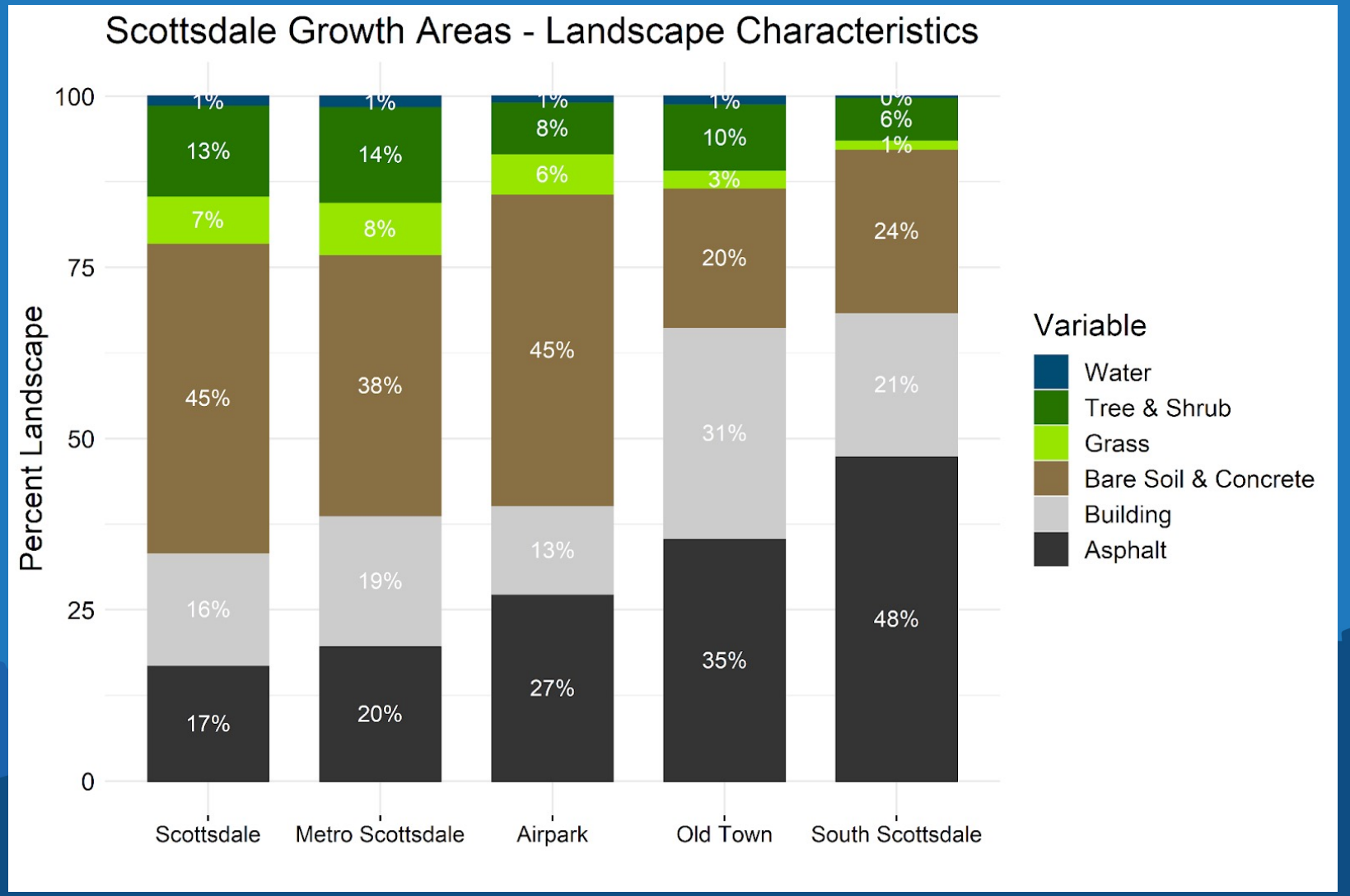
Land cover analysis



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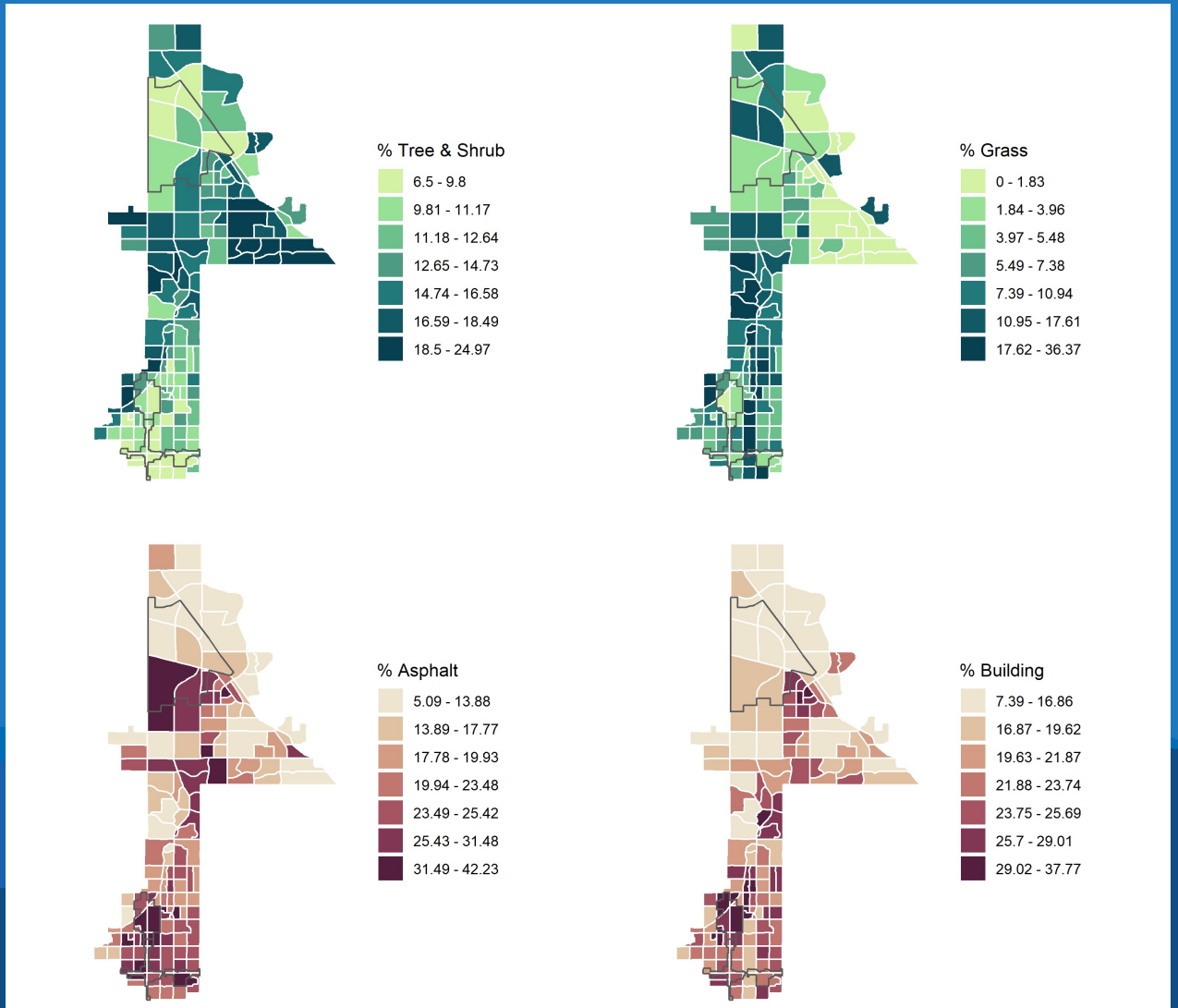
Land cover analysis



Percent landcover from 2015 NAIP imagery (Zhang & Turner 2020).

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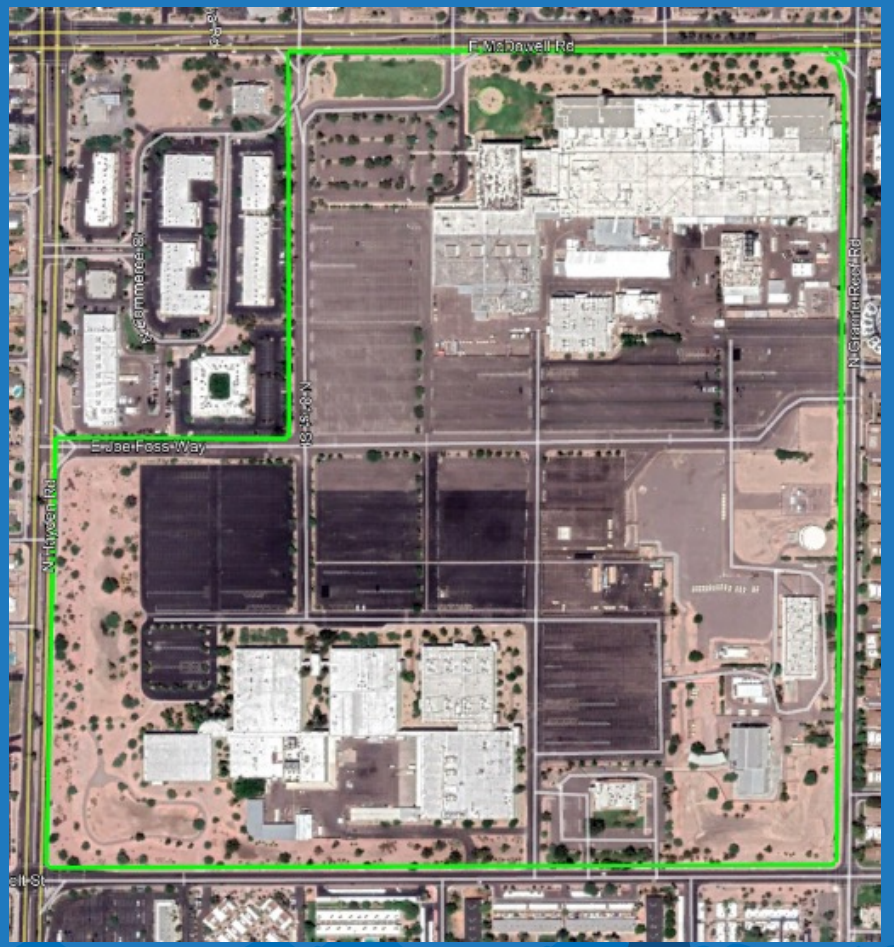
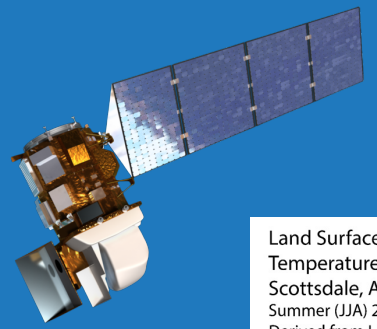
Land cover analysis

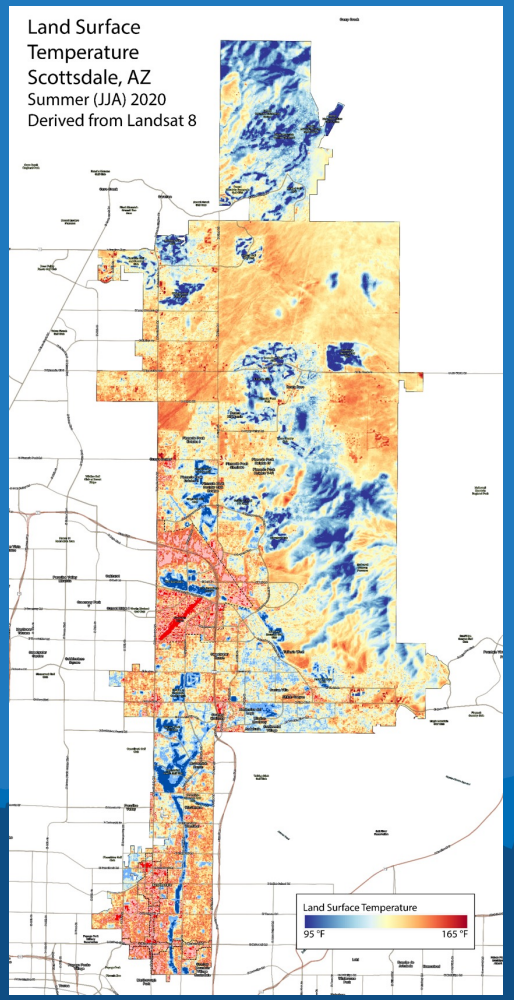
- 8201 E McDowell Road
- 68% building and asphalt
- 85.9 acres of building and asphalt



Land surface temperature analysis



- NASA LANDSAT
- 2015 and 2020, June-August
- Late morning overpass
- 30m resolution



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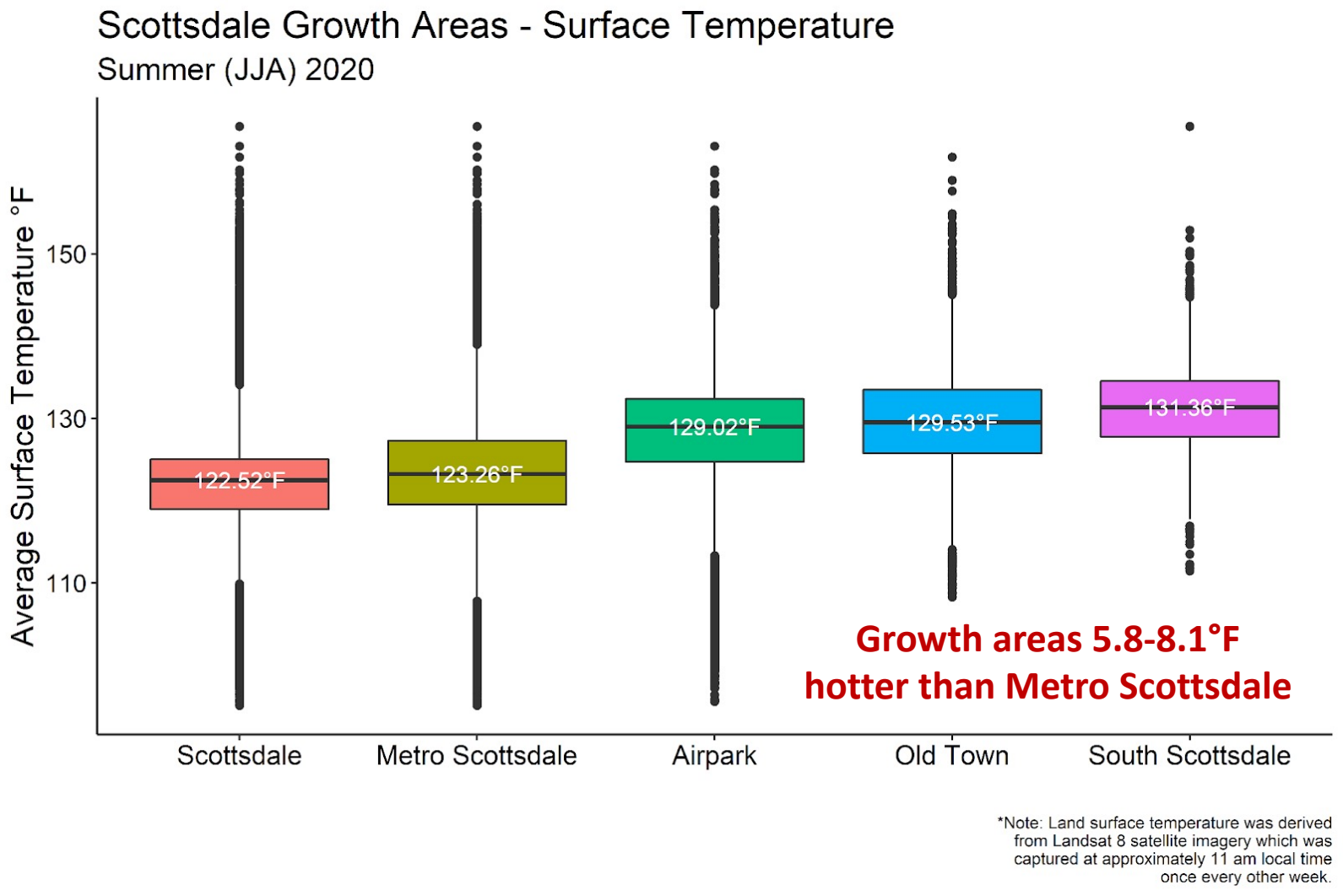
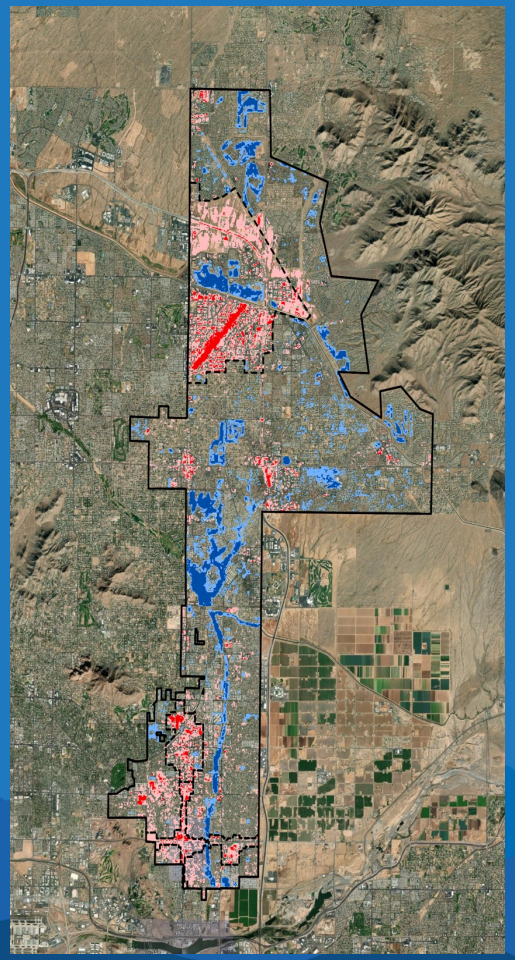
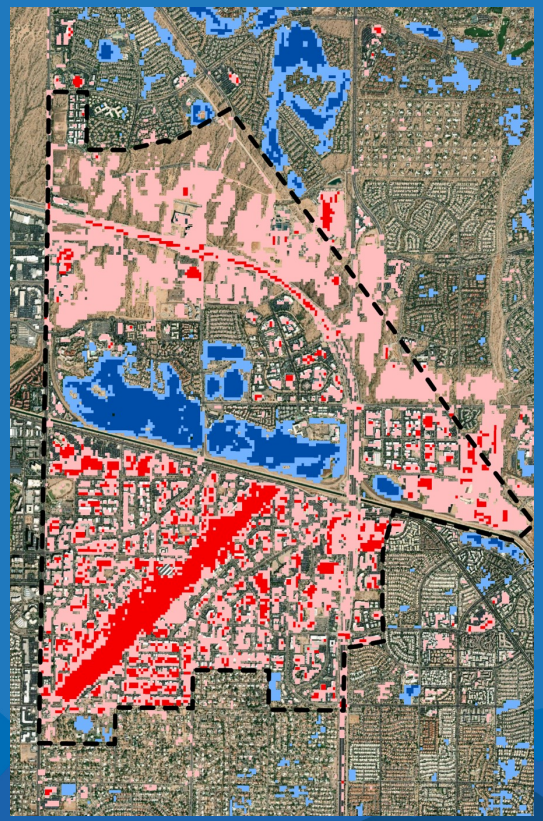
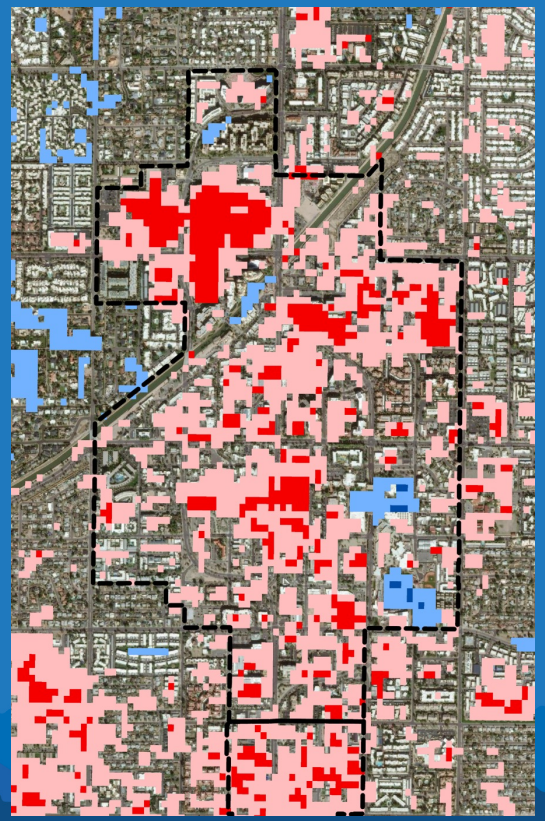
Land surface temperature analysis

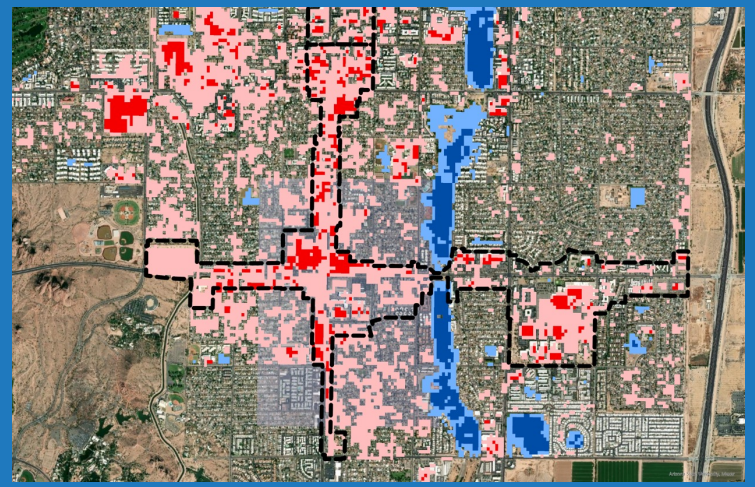


Land surface temperature analysis

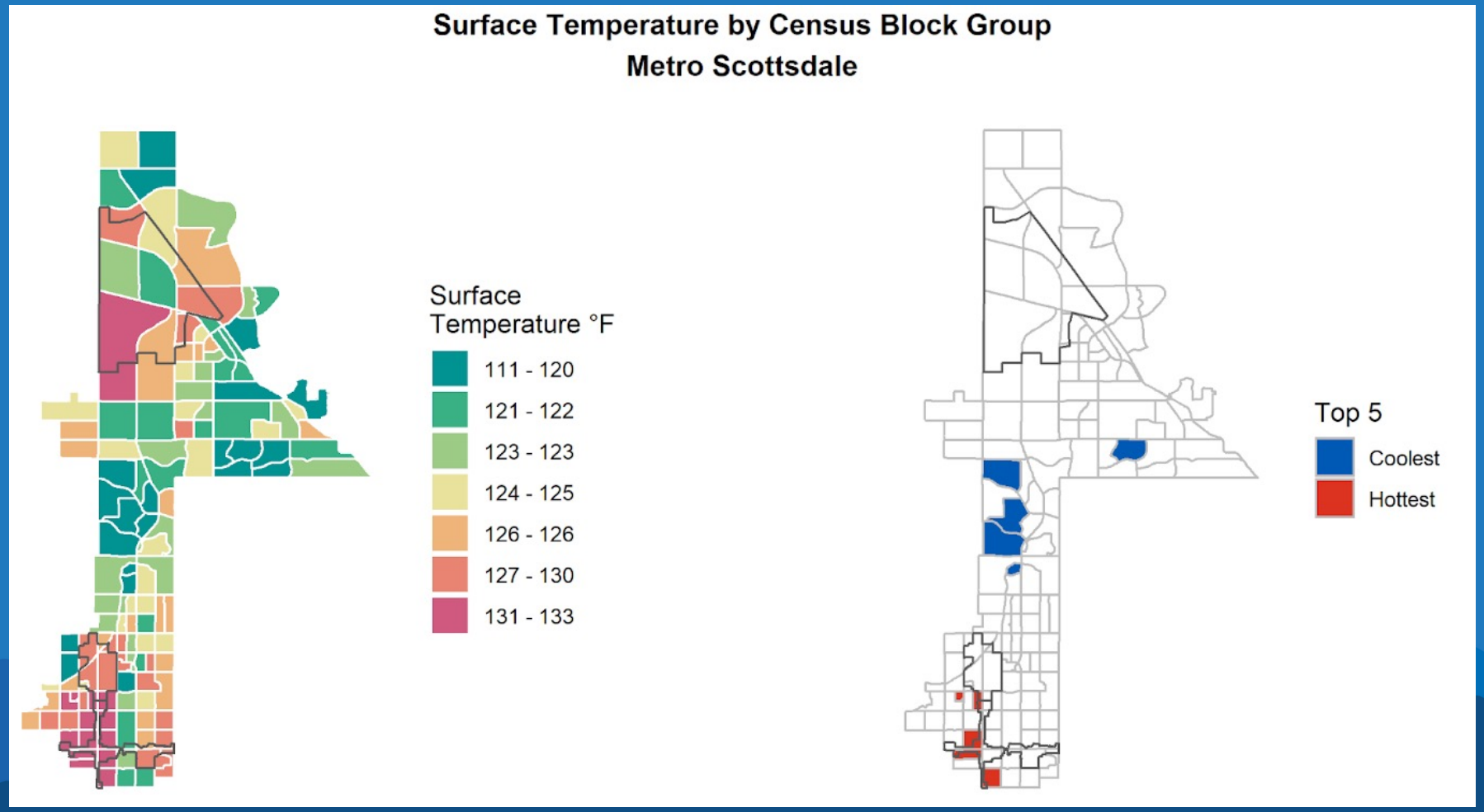




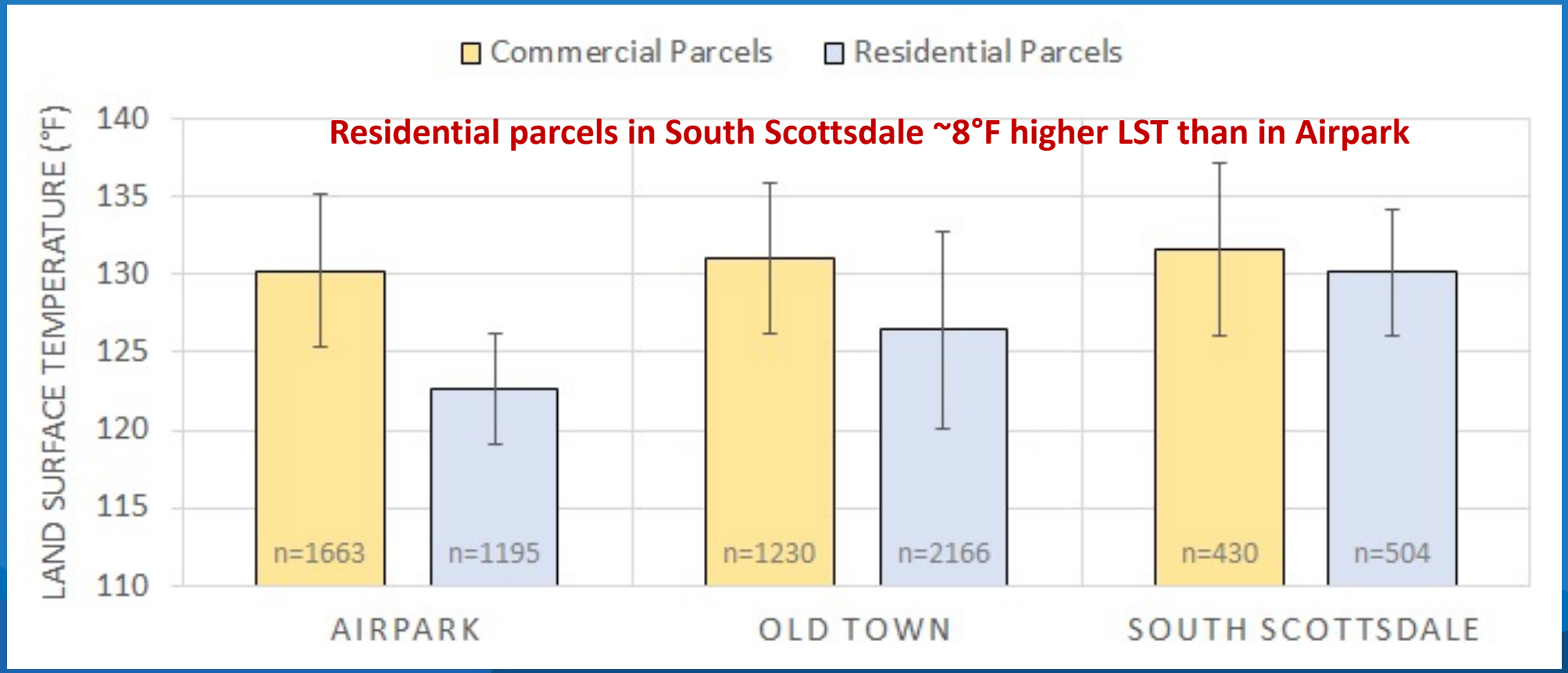




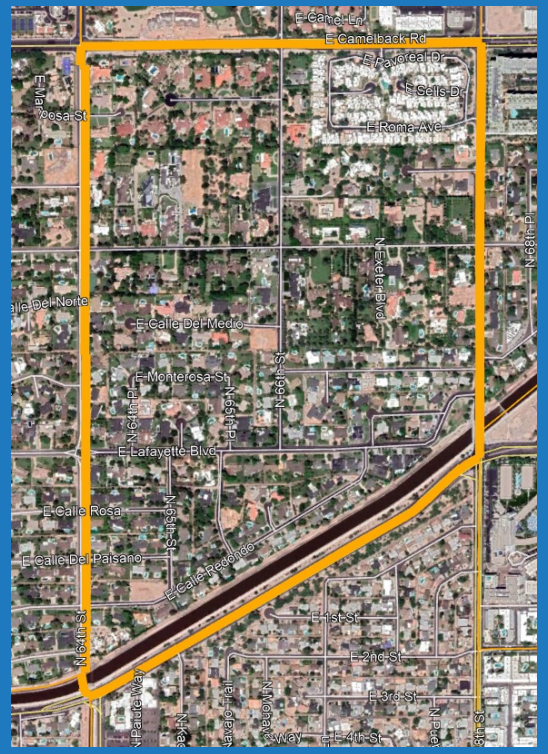
Land surface temperature analysis



Land surface temperature analysis



Land surface temperature analysis



Tract 7300, Block Group 2

23.8% Tree and Shrub coverage

Average block group = 13.8%

106.9°F average LST

Average block group = 118.3°F

Tract 7501, Block Group 2

8.8% Tree and Shrub coverage

Average block group = 13.8%

122.3°F average LST

Average block group = 118.3°F

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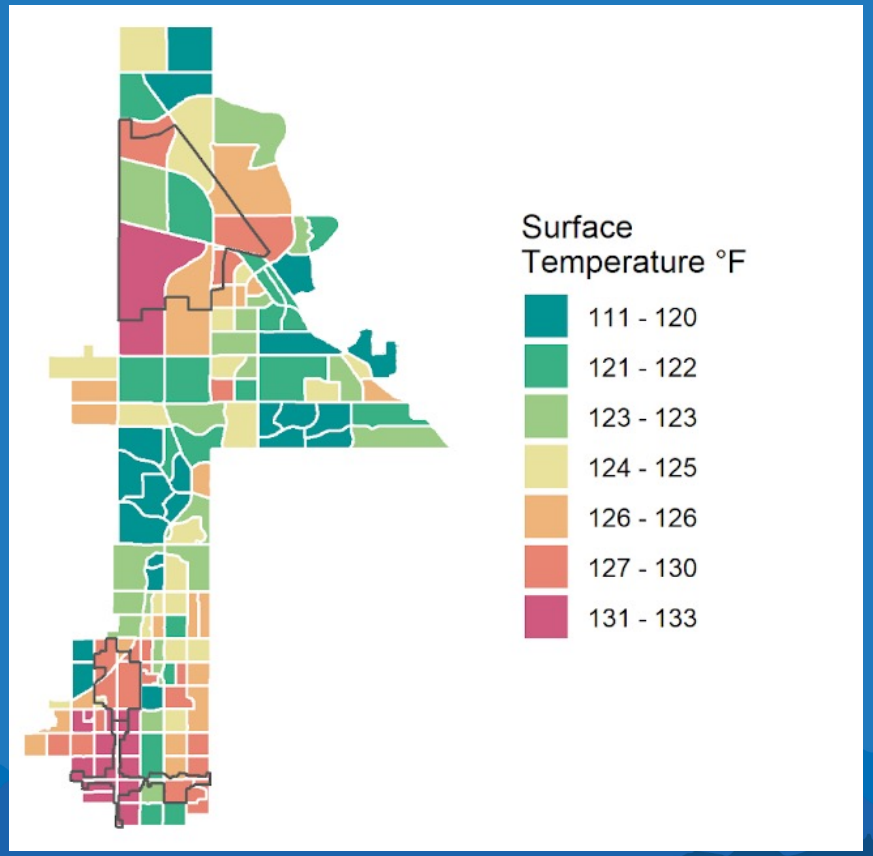
Land surface temperature modeling

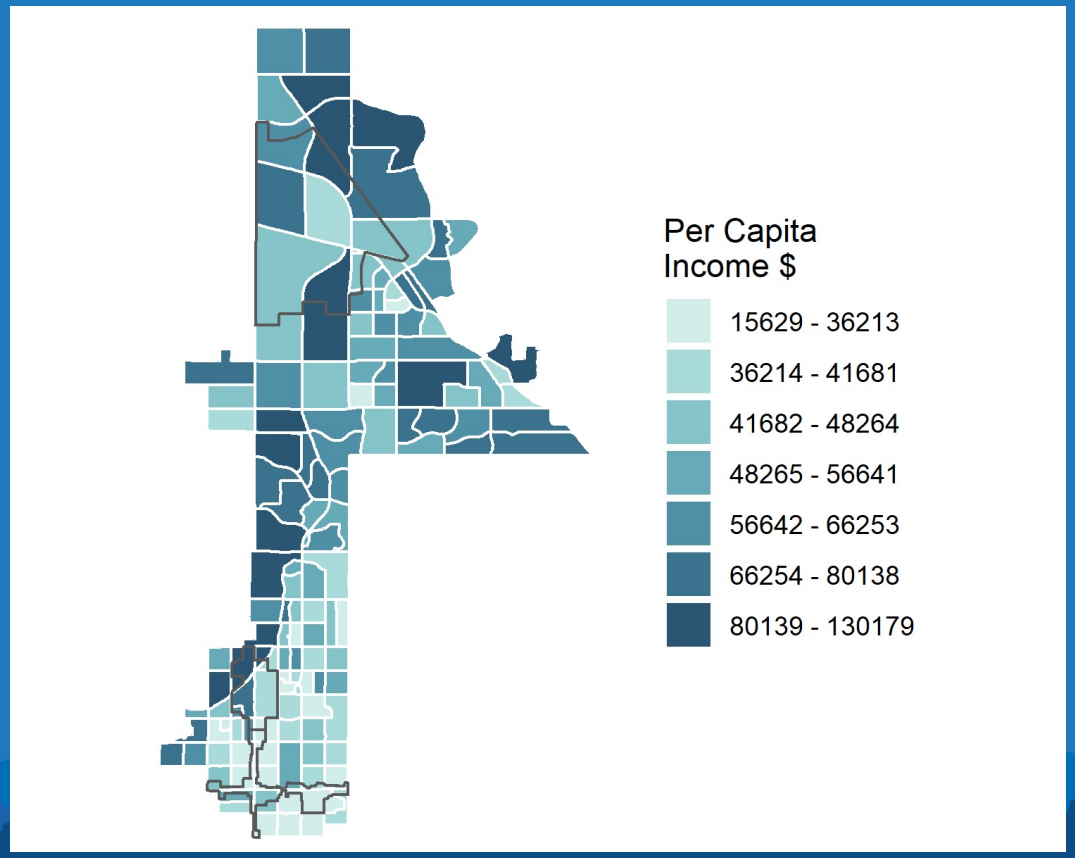
- Per 1% increase in land cover type in a census block group

Trees and shrubs	**0.59°F lower**
Grass	**0.39°F lower**
Asphalt	**0.31°F higher**
Building	**0.25°F higher**

"To avoid LST reductions, add 1 unit of trees/shrubs per 2 units of asphalt/building"

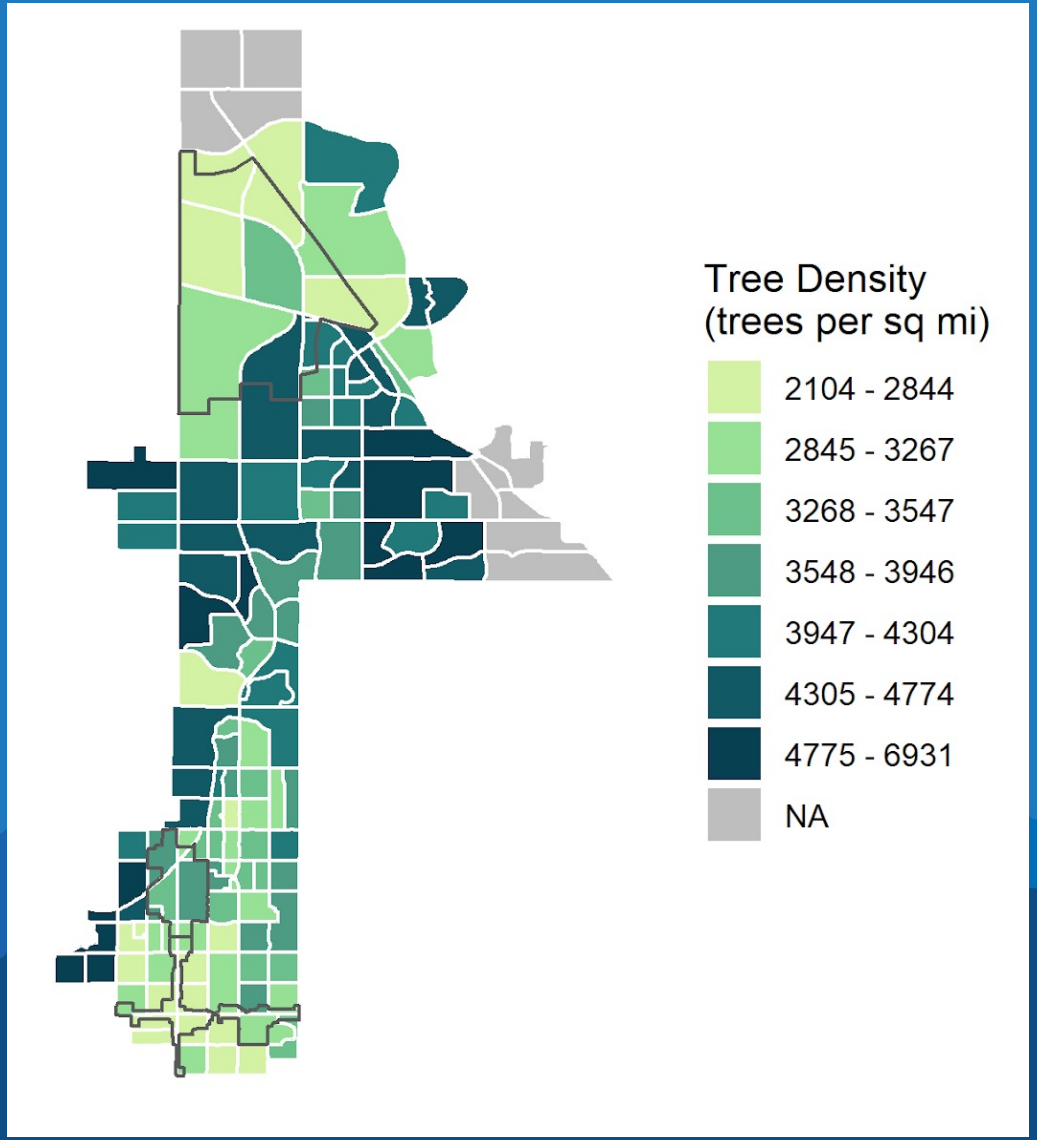
Land surface temperature modeling





Each $10,000 increase in census block group average per capita income was associated with a 1.13°F **reduction** in land surface temperature.

Tree canopy assessment



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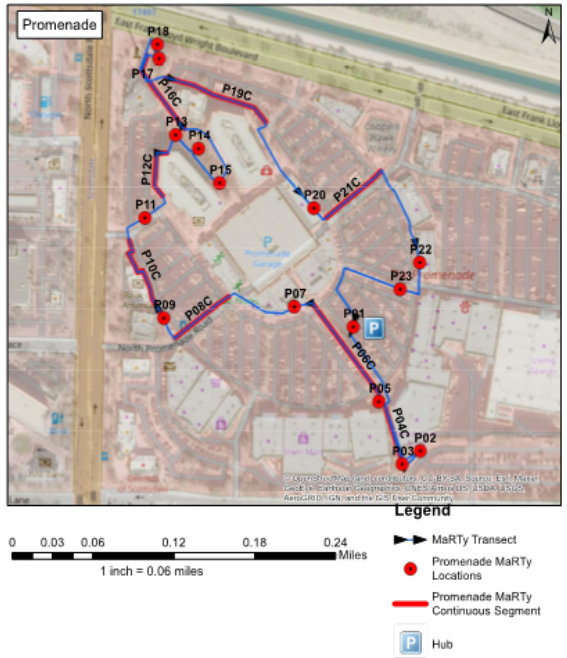
Microclimate assessment

Microclimate assessment

Scottsdale Promenade Transect

Transect length:
2050 m or 1.27 miles

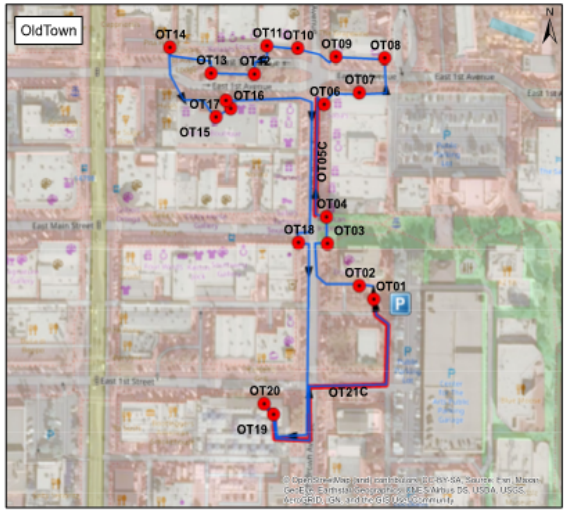


0 0.03 0.06 0.12 0.18 0.24 Miles
1 inch = 0.06 miles

Legend
- MaRTy Transect
- Promenade MaRTy Locations
- Promenade MaRTy Continuous Segment
- Hub

Scottsdale OldTown Transect

Transect length:
1050 m or 0.65 miles

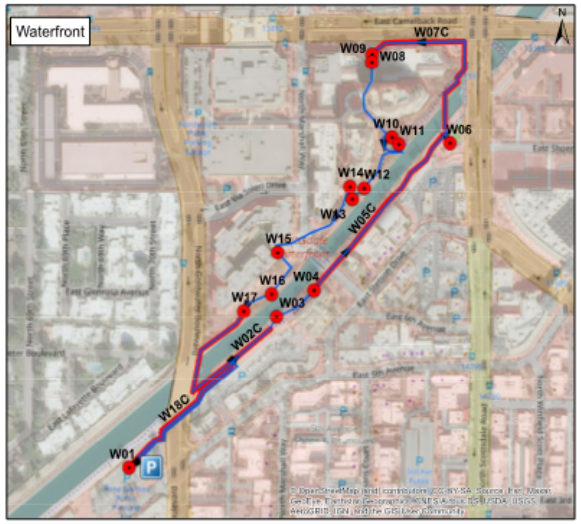


0 0.015 0.03 0.06 0.09 0.12 Miles
1 inch = 0.03 miles

Legend
- MaRTy Transect
- OldTown MaRTy Locations
- OldTown MaRTy Continuous Segment
- Hub

Scottsdale Waterfront Transect

Transect length:
1850 m or 1.15 miles

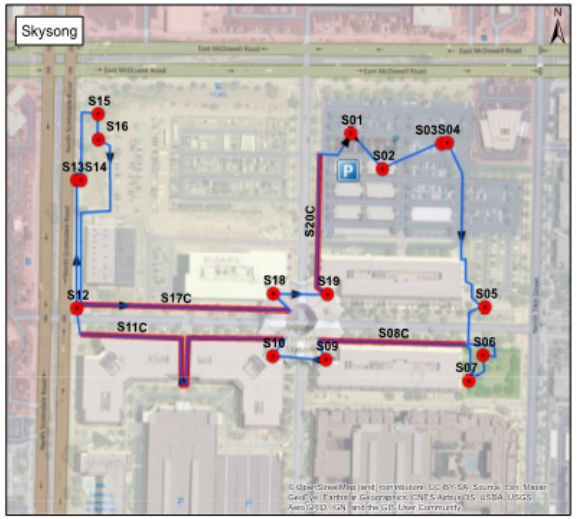


0 0.03 0.06 0.12 0.18 0.24 Miles
1 inch = 0.06 miles

Legend
- MaRTy Transect
- Waterfront MaRTy Locations
- Waterfront MaRTy Continuous Segment
- Hub

Scottsdale Skysong Transect

Transect length:
1600 m or 1.00 miles



0 0.02 0.04 0.08 0.12 0.16 Miles
1 inch = 0.04 miles

Legend
- MaRTy Transect
- Skysong MaRTy Locations
- Skysong MaRTy Continuous Segment
- Hub

Scottsdale Waterfront Transect

Scottsdale Skysong Transect

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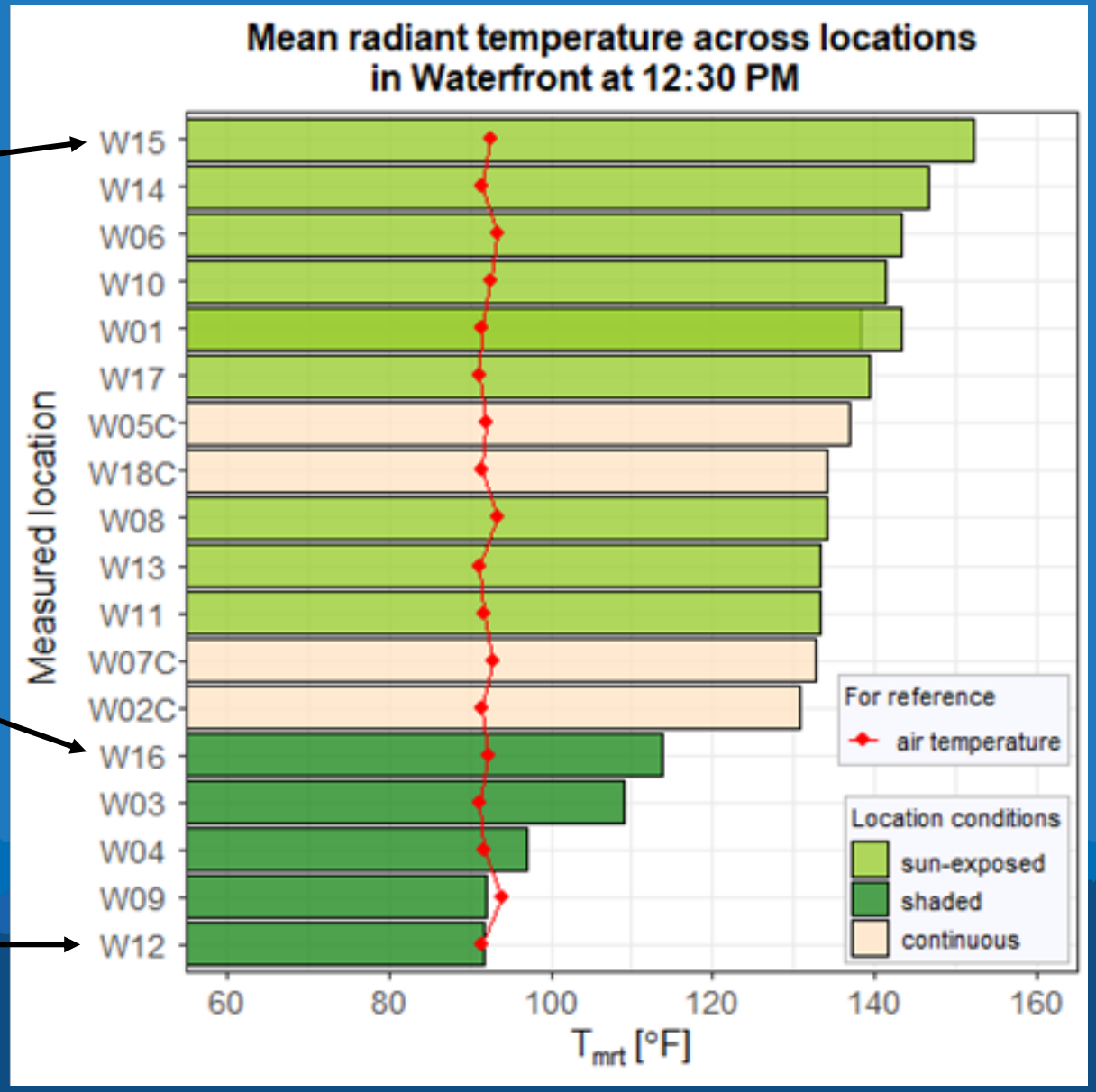
Microclimate assessment

Microclimate assessment

Naturally shaded outdoor green spaces have MRTs 35-60°F lower than exposed hardscapes



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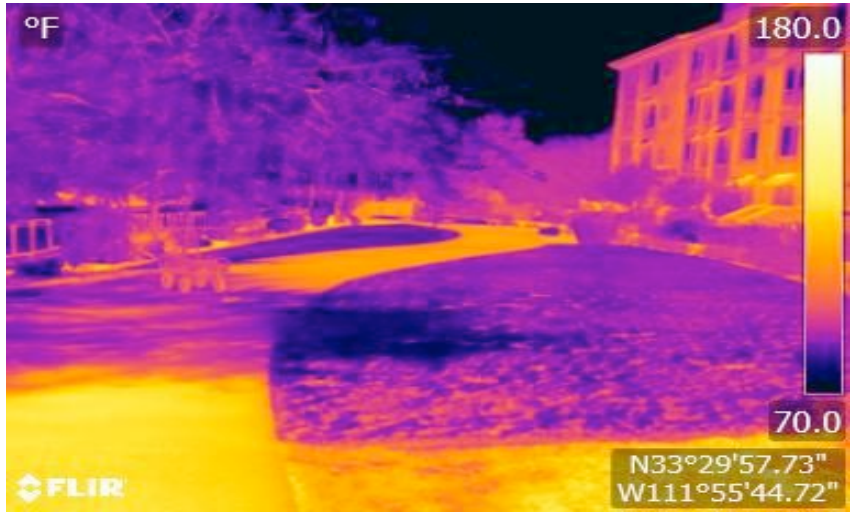
Microclimate assessment

W16



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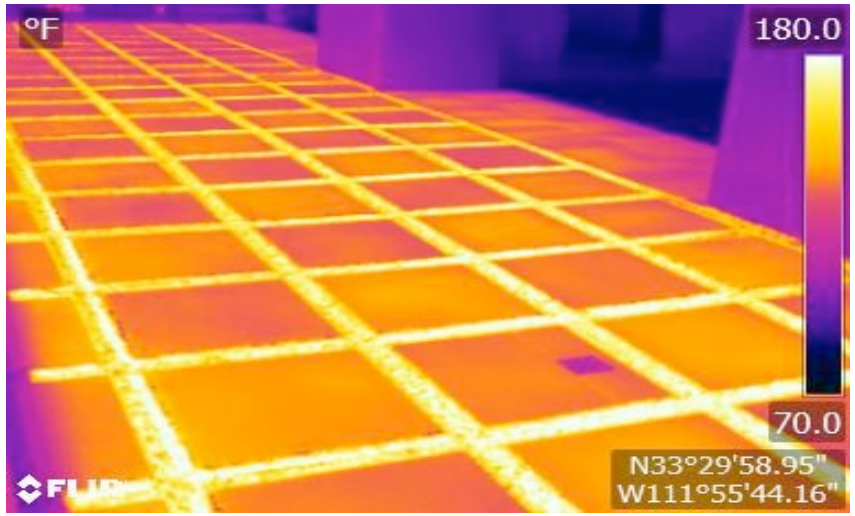
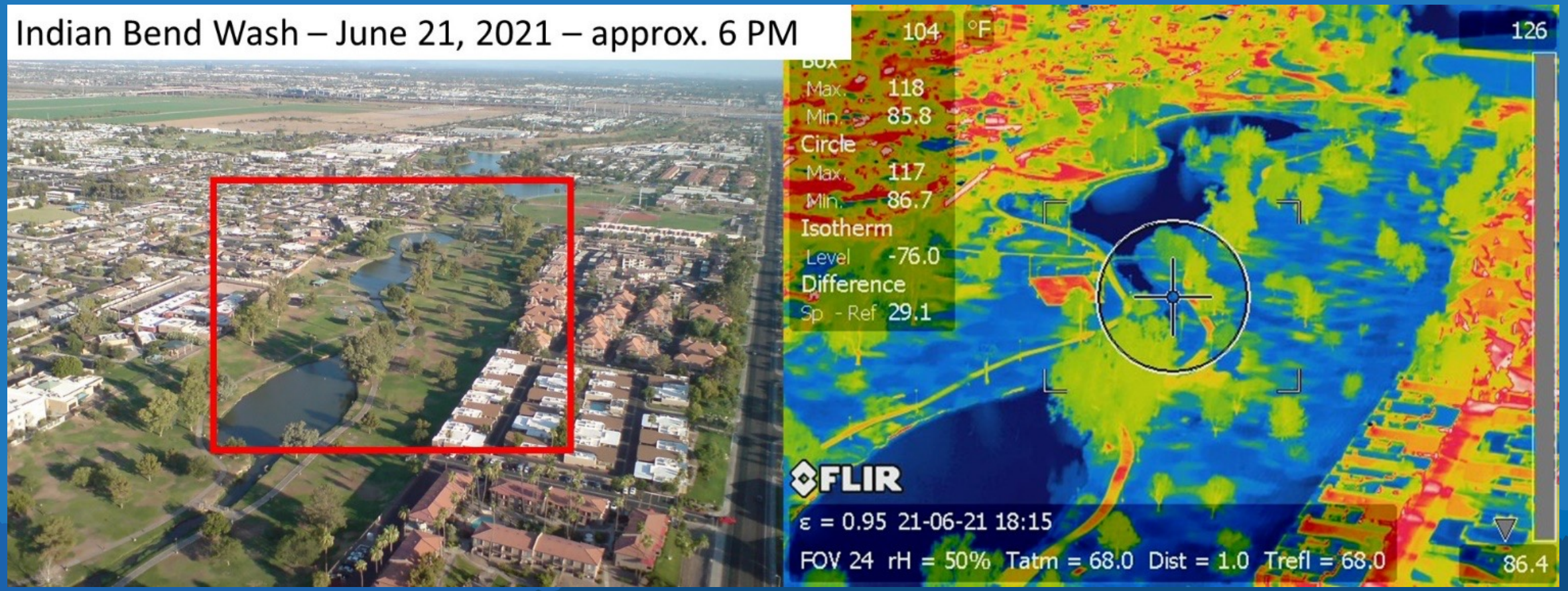


Airborne thermal photography + IBW stations



Recommendations – general comments

- Conceptual alignment with many city planning documents
- Not all plans and guidelines provide specific targets or mechanisms for evaluation/benchmarking
- New development vs. existing infrastructure
- Southern Scottsdale as a priority

Possible actions for R1 – Increase Tree Canopy

- Develop comprehensive urban forestry master plan, with supporting budget, personnel, enforcement, services
- Adopt goal for minimum tree coverage in all census block groups
- New recommendations, incentives, requirements for tree planting and preservation in growth areas and/or South Scottsdale
- Enhance partnerships with tree-related organizations

Possible actions for R2 – Reduce dark surfaces

- Cool roof inventory, energy consumption/building performance data
- Reflective roof surfaces for city infrastructure (test different options)
- Citywide cool roof program
- Cool pavement pilot program
- Shade structures for city-owned parking lots, incentives for private
- Temporary installations on large parking lots
- Add urban heat language to parking standards/requirements
- Increase shade coverage requirements for surface parking
- Economic analysis for shaded parking

Possible actions for R3 – Pedestrian shade

- More shade at more transit stops and other key routes/corridors
- Inventory of shade/cooling amenities along priority ped. routes
- Establish targets for shade coverage for pedestrian routes and mechanism for monitoring progress
- Community workshops to identify priority shade locations
- Inventory shade availability at bicycle racks, add shade
- Inventory shade availability at water fountains, add shade

Forthcoming in volume 2

- Expanded mean radiant temperature analysis
- Indian Bend Wash cooling assessment
- Expanded airborne thermal photography analysis
- Recommendations for waste heat, internal city govt actions

Identifying Strategies for a Cooler Scottsdale - Next Steps

- Short Term (1-2 Years)
  - ✓ *Strategies for a Cooler Scottsdale* will become component of Sustainability Plan
  - ✓ Incorporate Story-maps into city web site
  - ✓ Tree Ordinance – Tree City USA
  - ✓ Assess + strengthen ordinances, design standards, guidelines + incentives to increase tree canopy + consider urban heat island effects– particularly in Growth Areas
  - ✓ Reflective roof surfaces – city properties

- Longer Term (2+ Years)
  - ✓ Tree/Shade or Urban Forestry Plan(s) – particularly in Growth Areas
  - ✓ Develop recommendations, incentives and other programs for residential tree planting
  - ✓ Inventory shade/cooling amenities along walking routes, at bicycle racks, at public fountains – increase shade in these locations

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ASU Rob and Melani Walton Sustainability Solutions Service
Arizona State University

SEAC Work Study Session Outcome:

Commission Discussion/Questions + Answers

with ASU + City Staff

Possible SEAC Direction to Staff & ASU

Possible Recommendation to City Council

City Council Work Study Session September 14, 2021

Thank you

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